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BUILDING ENERGY SIMULATION USERNEWS

For Users of EnergyPlus, VisualSPARK, DOE-2, BLAST, Genopt, BDA, ENERGY-10 and their Derivatives

EnergyPlus Wins R&D 100 Award

R&D Magazine recently announced that EnergyPlus is one of the winners of the 41st annual R&D 100 Awards, which honor the 100 most technologically significant new products of the year.

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GLARE INDEX

I've simulated the daylight performance of a residential block which includes a kitchen, a living room, two bedrooms and a master bedroom. I called out the annual glare index with hourly basis of each room. The results show that there is no glare (means 0) in the kitchen, one bedroom and the living room; however, there are glare indexes in other two rooms. The five rooms each has a window facing with the same direction (east). Since I know glare index never reaches 0, what's happening and how can I solve the problem?

Answer
The coordinates or facing angle of the daylighting reference point in these zones might be incorrect. Remember that daylighting reference points are always relative to the zone origin, even when World Coordinates have been specified. In the dxf drawing file, the daylighting reference points are drawn as small red circles to help you verify the location. You may need to comment out all of the daylighting objects and then add them back one by one to make sure each reference point is within the appropriate zone.

NON-CLOSED SPACES

I understand that EnergyPlus does not need a closed space in order to do an energy calculation. If I have a space for which I have not specified a roof or floor, what assumption will EnergyPlus make about these surfaces?

Answer
You are correct that EnergyPlus does not need a completely enclosed space to perform a load or an energy calculation. In addition, EnergyPlus will not assume any "default" values for things that do not exist because it does not check for the presence of, say, a roof or floor in every zone. The lack of any particular surface is basically ignored from the perspective of heat transfer through it and interaction with other defined surfaces within a zone. Note, however, that the lack of a surface does not leave a big hole through which you would receive more ventilation, infiltration, etc. The basic philosophy inside EnergyPlus is this: what the user does not define is not simulated and something will affect the simulation only if the user defines it. Lack of a particular surface could be seen as one way of specifying an adiabatic surface without any thermal mass.

SINGLE ZONE SYSTEM

I would like to simulate a Single Zone system with an economizer, i.e., a constant volume system that heats or cools the air as required to meet the zone setpoint, and has an outdoor air mixer. The system should not use both heating and cooling coils at the same time (as in a constant volume reheat system). What is the easiest way to set up this system in EnergyPlus?

Answer
The SmOffPSZ.idf example file illustrates the type of system you want to model. You can substitute a chilled water coil for the dx coil in the example, if desired.

Ask An EnergyPlus Expert

PURCHASED AIR

When using purchased air, the report "Purchased Air Cooling Sensible Cooling Energy" is higher than "Purchased Air Total Cooling Energy." Shouldn't the latter be higher since it consists of both sensible and latent loads?

Answer
The purchased air model is very simple but it can produce confusing results when the outside air option is used. The purchased air model takes return air from the zone and mixes it with the specified outside air volume. If the purchased air flow rate is less than the outside air flow rate, then the purchased air flow rate is used and is 100% outside air. It then takes this mixed air condition (dry bulb temperature and humidity ratio) and calculates the enthalpy change required to condition this air to the specified supply air temperature and humidity ratio. This is the total cooling reported. It also determines the sensible change required, and this is the sensible cooling reported. If the mixed air is drier than the specified supply air humidity ratio, then the total cooling will be less than the sensible cooling.

Purchased air with the outside air option is useful for determining peak loads. If you are using purchased air for an annual load, it is better to introduce the outside air directly to the space using ventilation or infiltration.

MORE PURCHASED AIR

How do I use the night temperature setback feature when doing energy efficiency analysis performance improvements with the purchased air? I am varying the level of insulation, window size and types

Answer
Night temperature setback is controlled via the thermostat setpoint schedules. Use the DUAL SETPOINT WITH DEADBAND thermostat type (control type = 4). Setback is accomplished by varying the heating and cooling setpoint schedules. The PSZDrawThru.idf example file has details.

DAYLIGHTING, INTERREFLECTION

I noticed that after changing the wall color, I got different lighting illuminance results. Am I correct to assume that EnergyPlus takes "light bouncing" into consideration?

Answer
Yes, when you are performing daylighting analysis as part of your EnergyPlus simulation, interreflection of visible light between interior surfaces is taken into consideration. The appropriate visible reflectance of each interior surface must be input to account for different surface "colors."

- When using the Daylighting:Detailed method in EnergyPlus, the effects of interreflection are calculated using a "split-flux" method. This is described in the Daylighting and Window Calculations section of the EnergyPlus Engineering Document that is part of the included documentation.

- When using the Daylighting:DElight method in EnergyPlus, the effects of interreflection are calculated using a "radiosity" method.

Ask An EnergyPlus Expert

INFILTRATION

I am simulating a two story office building with a corridor in both stories. In the simulation, the corridor is unconditioned because the doors are assumed to be open all day. Therefore, it is difficult to control the temperature of the corridors. However, the temperature of the corridors may be less than the outside environment due to the infiltration from the conditioned rooms. How can I consider the outside environment of the walls that are exposed to the corridors?

Answer
You should model the corridor as a separate thermal zone, and the walls between the conditioned rooms and the corridor should be interzone heat transfer surfaces with OutsideFaceEnvironment=OtherZoneSurface, and OutsideFaceEnvironmentObject=corresponding wall in the corridor zone.

Question
I don't understand how to estimate the constants A, B, C, and D in the infiltration equation. In the Input Output Reference it says only that these values are user-specified constants and they are dependent on the external environment. How do I estimate these constants for a given climate?

Answer
The question of typical values for these coefficients is subject to debate. Ideally, one should do a detailed analysis of the infiltration situation and then determine a custom set of coefficients using methods such as those laid out in Chapter 26 of the ASHRAE Handbook of Fundamentals. The EnergyPlus defaults are 1,0,0,0; this gives a constant volume flow of infiltration under all conditions. The coeffeicients are not climate-dependent, rather they are dependent on the types of openings and cracks present in the building.

BLAST (one of the EnergyPlus predecessors) used the following values as defaults: 0.606, 0.03636, 0.1177, 0. These coefficients produce a value of 1.0 at 0C ΔT and 3.35 m/s (7.5 mph) windspeed, which corresponds to a typical summer condition. At a winter condition of 40C ΔT and 6 m/s (13.4 mph) windspeed, these coefficients would increase the infiltration rate by a factor of 2.75.

In DOE-2 (the other EnergyPlus predecessor), the air change method defaults are (adjusted to SI units) 0, 0, 0.224 (windspeed), 0. With these coefficients, the summer conditions above would give a factor of 0.75, and the winter conditions would give 1.34. A windspeed of 4.47 m/s (10 mph) gives a factor of 1.0.

The source of the BLAST defaults is noted in the BLAST documentation as:

> *"Empirical equation and the coefficient default were determined from ASHRAE journal articles and other data on the effects of outdoor weather conditions."*

The source of the DOE-2 defaults is based on examining the infiltration relationships described in the ASHRAE Handbook of Fundamentals.

The EnergyPlus example files use all of the above: the BLAST defaults in some (GeometryTest), the DOE-2 defaults in some (5ZoneAirCooled), and the EnergyPlus defaults in some (LgOffVAVDetCoil).

Ask An EnergyPlus Expert

FALSE CEILING

I'm simulating a building with a false ceiling in some zones. I defined the false ceiling as an OtherZoneSurface and the roof as an ExteriorEnvironment. Now I need to erase the warnings caused by this situation.

Answer
Try using a separate Zone for the ceiling's plenum space. The "floor" of this interstitial space is an interior partition -- actually the suspended ceiling. The ceiling surfaces are described in conforming pairs (one for the room and one for the ceiling space) and use each other for OtherZoneSurface names. The Roof is then part of the ceiling plenum's Zone.

ENERGY CONSUMPTION COMPARISONS

I have two VAV systems, one is with a reheat coil and the other is with a baseboard heater. So, assuming that they are in the same location and of the same construction, if the heating loads are the same no matter what system is chosen, and if I use purchased hot water only for heating, the "purchased hot water energy" outputs for the two systems should be same, right?

However, since the heat transfer algorithms for the two systems are different, then the total HVAC energy consumption spent by the two systems is going to be different. The question then is which output shows the total HVAC energy spent for a specific system?

Answer
If the heating and cooling setpoints are different, then there will be a difference in heating energy consumption when the zone requires cooling. The consumption should be the same when the zone requires heating. To compare heating output, see the reports "Baseboard Heating Energy (or Rate)" and "Total Water Heating Coil Energy (or Rate)." To compare heating supply input, see the report "Purchased Hot Water Energy (or Rate)." If the water flow rates for the two systems are different, then the "Pump Heat To Fluid (or Energy)" will also be a small factor.

CHANGING PROPERTIES

I am working on a model of a test cell where we are allowing the temperature to float. Is there a way in EnergyPlus to model materials where the thermophysical and heat transfer properties (i.e., like thermal conductivity) change with respect to temperature?

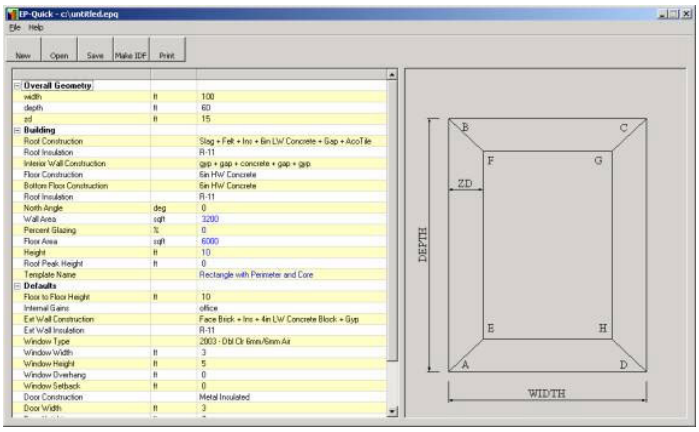
Answer
Sorry, the material properties cannot be made temperature-dependent. If you know the property variation that you expect, you could bracket things (and check sensitivity on this) by inputting high and low versions of the properties and doing separate EnergyPlus runs. However for window assemblies, performance is somewhat temperature-dependent; this is because EnergyPlus uses the Window 5 algorithms rather than constant window performance factors.

EP-QUICK

Beta Test of EP-Quick (Beta Test ends September 30!)
EP-Quick is a simple program that creates an EnergyPlus input file for a building without HVAC. Using simple templates you create the building shape and zone layout. EP-Quick is not a full interface for EnergyPlus but simply a way to generate input files quickly.

The installer may be downloaded from **http://www.gard.com/ep-quick/EP-Quick-Setup.exe**

To use it, press the "NEW" button and select a template and the types of floors. Once a template is selected, zoning and shape are fixed but the overall dimension of the building can be changed. The buildings are "prismatic" and are the same shape and size on all floors. Windows and doors may be added and constructions and schedules may be modified.



Use main "tree" interface to examine and modify the many different details of the building. The main parts of the tree are:

- Overall Geometry - depth, width
- Building - roof, floor, interior constructions
- Defaults - default values used in "Floorplans"
- Internal Gain Types - lighting, people, schedules
- Floorplans - zones, exterior walls, windows, etc
- Corners - locations of the building vertices
- Roof corners - locations of special roof vertices

Please take a look at the software and the resulting IDF files. We need your feedback on:

- Bugs
- User Interface
- Capabilities
- Price
- Templates desired

The beta test will end and the beta version will stop working on September 30 but please send your comments to me a soon as possible. GARD Analytics did not develop EP-Quick and will not be involved in its distribution or support but has kindly agreed to host this web page for the beta test of EP-Quick.
Jason Glazer, Developer of EP-Quick, **jglazer@gard.com**

The Forecast Looks Favorable for …

(Free!) Weather Data on Demand

You can access archived weather data from around the world through this U.S. DOE web interface:

www.eere.energy.gov/buildings/energyplus/cfm/weatherdata/weather_request.cfm

Hourly weather data is continuously collected and stored into a local database, available through this web interface. Most stations have information for dry bulb temperature, wet bulb temperature, wind speed/direction, atmospheric pressure, visibility, cloud conditions, and precipitation type.

EnergyPlus NEW WEATHER FILES

- **Spanish Weather for Energy Calculations (SWEC)**

  Originally developed for use with Calener, a new program for building energy labeling in Spain, these weather files cover all 52 Spanish provincial capitals. Calener was developed by the Grupo de Termotecnia of the Escuela Superior de Ingeneiros in Seville for the Spanish Government. The weather files were synthetically generated using Climed (Portuguese software developed by Ricardo Aguiar) from mean monthly data coming from the Spanish Meteorological National Institute. These weather files were converted from the DOE-2 binary to EnergyPlus format and include constant wind speeds of 6.7 m/s.
  Our thanks to profesor Luis Pérez-Lombard and the Grupo de Termotecnia of the Escuela Superior de Ingenieros for sharing these data with the EnergyPlus community.

- **New Weather Data for Central America and Cuba**

  We are happy to announce the availability of new EnergyPlus-format weather data for 37 locations in Central America (Belize, El Salvador, Guatemala, Honduras, and Nicaragua) and Cuba. The data are from the Solar and Wind Energy Resource Assessment project, funded by the United National Environment Programme, Global Environment Facility. (More information on SWERA is available on their web site: http://swera.unep.net/). Thanks to SWERA for making these data available.

This brings the total number of weather files available to 665 with more than 280 in the US, 55 in Canada, and 320 around the world. All the new data are available on the international weather page of the EnergyPlus web site: http://www.energyplus.gov/cfm/weatherdata_int.cfm

If you know of other typical weather data that could be shared with EnergyPlus users, please contact Dru Crawley or Linda Lawrie directly. There are another set of 60+ files created for Italy that we plan to post as soon as time allows.

***SPARK** is an equation-based simulation environment that allows you to build customized models of complex physical processes by connecting calculation objects that represent system components like walls, fans, heat exchangers, chillers, ducts, mixing boxes, controls, etc. It is aimed at the simulation of innovative and/or complex building systems that are beyond the scope of whole-building programs like DOE-2 and EnergyPlus. **VisualSPARK** adds a graphical user interface to SPARK to simplify its use.*

Download VisualSPARK free of charge from

http://simulationresearch.lbl.gov/

Please go to our website to download new VisualSPARK documentation:

- **New Features, Bug Fixes, and Changes**
- **Frequently Asked Questions**
- **How To Port Atomic Classes To SPARK 2.*x***
- **Theoretical Speed-Up Using SPARK**

SPARK was developed by the Simulation Research Group at Lawrence Berkeley National Laboratory and by Ayres Sowell Associates, with Support from the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technologies Program of the U.S. Department of Energy, Program Manager Dru Crawley.

EnergyPlus Version 1.2

To download a free copy of the program go to www.energyplus.gov

EnergyPlus Support Tools

Support software is listed on our website (http://SimulationResearch.lbl.gov/EP/ep_tools.html) and in Section 2 of this newsletter.

EnergyPlus Weather Data from www.energyplus.gov/

There are 275 locations in the United States, 16 California thermal zones, 55 Canadian locations, and 233 international locations in more than 80 countries.

Ask an EnergyPlus Expert

Questions from EnergyPlus users are answered promptly via email by program developers. To submit questions, join the EnergyPlus User Group at http://groups.yahoo.com/group/EnergyPlus_Support/.
A selection of questions/answers are compiled (yearly) into a downloadable PDF document:
Q and A for 2002, Q and A for 2003.

EnergyPlus Validation

For reports about testing and validation, go to
http://www.eere.energy.gov/buildings/energyplus/testing.html.

Are you an EnergyPlus Consultant ?

If you are engaged in EnergyPlus consulting, and would like to be listed in the *Building Energy Simulation User News* and on our website (http://SimulationResearch.lbl.gov), please send details to klellington@lbl.gov.

Join the EnergyPlus User Group

The developers of EnergyPlus have formed a support group to foster discussion and maintain an archive of information for program Users. We invite questions about program usage and suggestions for improvement to the code. Go to http://groups.yahoo.com/group/EnergyPlus_Support/

Translate EnergyPlus Web Pages

A new link on the main EnergyPlus web page (www.energyplus.gov/) allows you to view the pages in any of eight languages. Unfortunately, the translator doesn't work with PDF files. Look for the fish at the bottom of the web page. Pages may be translated into Chinese, French, German, Italian, Japanese, Korean, Portuguese and Spanish.

EnergyPlus is being developed by University of Illinois and Lawrence Berkeley National Laboratory, with the assistance of DHL Consulting, C. O. Pedersen Associates, Florida Solar Energy Center, GARD Analytics, the National Renewable Energy Laboratory, Oklahoma State University and others. Development of EnergyPlus is supported by the U. S. Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technologies Program (Program Manager, Dru Crawley).

GenOpt 2.0
Generic Optimization Program

GenOpt is an optimization program for the minimization of a cost function, such as annual energy use, that is evaluated by an external simulation program. GenOpt can be used with any simulation program -- such as EnergyPlus, SPARK or DOE-2 -- that has text-based input and output. It also offers an interface for adding custom optimization algorithms to its library.

GenOpt processes discrete independent variables, such as different window constructions, either for optimization problems with mixed discrete and continuous independent variables or for doing parametric studies. Some simulation programs, such as EnergyPlus, cannot pre-process the independent variables or post-process values that are computed during the simulation. For such situations, *input function objects* and *output function objects* can now be used without having to modify *GenOpt's* source code.

***GenOpt 2.0* (with documentation) may be downloaded free of charge from**

http://SimulationResearch.lbl.gov

HOMER !!

HOMER is a computer model that simplifies the task of evaluating design options for both off-grid and grid-connected power systems for remote, stand-alone, and distributed generation applications. HOMER's optimization and sensitivity analysis algorithms allow you to evaluate the economic and technical feasibility of a large number of technology options and to account for variation in technology costs and energy resource availability. HOMER models both conventional and renewable energy technologies such as wind turbines, solar photovoltaic, hydrogen, fuel cells, battery banks, etc. HOMER is free.

http://www.nrel.gov/homer/

For some pastry-related fun, see p. 19 of this newsletter ◉ the Doughnut Maze!!

Southern California Gas Company

Educational Programs ➤◄ September 2004

http://www.socalgas.com/business/resource_center/erc_seminar_info.shtml

September 8 & 9	Air Balance (two-night program) (Seminar 11423)
September 8	Boiler Water Treatment for Energy Efficiency (Seminar 11433)
September 8	EnergyPro® (State-Certified Software): Envelope/Lighting/Windows (Seminar 11361)
September 9	EnergyPro® (State-Certified Software): Advanced (Seminar 11363)
September 14 & 16	Air Balance (two-night program) (Seminar 11424)
September 15	Certified Permitting Professional's Update (Title V) (Seminar 11397)
September 16	Understanding Boiler Basics (Seminar 11437)
September 21	Building Commissioning (Seminar 11258)

The Gas Company's Energy Resource Center, 9240 Firestone Boulevard., Downey, CA

Recent Reports

This report is available from the Simulation Research Group at Lawrence Berkeley National Laboratory.

LBNL-55521 (download document here)

THE DEVELOPMENT OF RESIDENTIAL AND COMMERCIAL BUILDING ENERGY STANDARDS FOR EGYPT

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ABSTRACT
In 2000, the Housing and Building Research Centre of Egypt obtained a United Nations grant to develop energy standards for residential and commercial buildings in Egypt. Over the past three years, the authors have worked as an international consultant team, bringing to the project many years of experience in the development of building energy standards in the US and other countries, surveys of existing building conditions and energy use, the use of computer simulations to analyze building energy performance, and the design and construction of energy-efficient buildings. The proposed residential energy code was completed in June 2003, to be followed by the proposed commercial energy code in the spring of 2004. Both of these standards will then undergo a public review process prior to being submitted to the government for promulgation. While the codes were being finalized, the authors also developed a detailed implementation plan for putting into place the infrastructure, training, and supporting materials and software to properly promulgate and enforce the codes, as well as initiate a major program of demonstration buildings to transform the Egyptian market for energy efficiency in buildings. The entire project will be completed by summer 2004.

A key component in the development of the proposed codes is the use of the DOE-2 hourly energy simulation program to evaluate building energy performance. The authors have devoted months of effort in providing training in the use of the DOE-2 program, both in Egypt and in the U.S., and provided technical support in developing Egyptian weather data and a Windows-based program to do parametric DOE-2 simulations.

Several prototypical residential and commercial buildings have been developed that have been used by the project Simulation Working Group to evaluate the energy savings from a comprehensive set of envelope and HVAC system measures. Since not all buildings in Egypt are equipped with mechanical cooling, we also added the Fanger Comfort Model to DOE-2 that enabled the consultant and Egyptian teams to estimate improvements in indoor comfort in addition to building energy savings.

This paper will describe the overall scope of the project, the research efforts undertaken in support of the standards, and give an overview of the draft residential and commercial building energy efficiency codes.

Recent Reports

This report is available from the Simulation Research Group at Lawrence Berkeley National Laboratory.

LBNL-55518 (download document here)

ENERGYPLUS: AN UPDATE

Drury B. Crawley[1], Linda K. Lawrie[2], Curtis O. Pedersen[3], Frederick C. Winkelmann[4], Michael J. Witte[5], Richard K. Strand[3], Richard J. Liesen[3], Walter F. Buhl[4], Yu Joe Huang[4], Robert H. Henninger[5], Jason Glazer[5], Daniel E. Fisher[6], Don B. Shirey, III[7], Brent T. Griffith[8], Peter G. Ellis[8], and Lixing Gu[7]

[1] U S Department of Energy, [2]DHL Consulting, [3]University of Illinois, [4]Lawrence Berkeley National Laboratory, [5]GARD Analytics, [6]Oklahoma State University, [7]Florida Solar Energy Center, [8]National Renewable Energy Laboratory

ABSTRACT

A new building energy simulation program, known as EnergyPlus, was first released in April 2001. Building on the capabilities and features of BLAST and DOE-2, EnergyPlus includes many simulation features that have not been available together in a mainstream building energy simulation program. Some key capabilities include variable time steps, configurable modular systems integrated with heat balance-based zone simulation, multiple comfort models, daylighting and advanced fenestration, multizone airflow, displacement ventilation, flexible system modeling, and photovoltaic and solar thermal simulation. Since EnergyPlus was released in April 2001, more than 24,000 copies have been downloaded. The paper provides an overview of the capabilities and strengths of EnergyPlus in comparison with DOE-2 and BLAST.

LBNL-55517 (download document here)

DEVELOPMENT OF TRADE-OFF EQUATIONS FOR ENERGYSTAR© WINDOWS

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ABSTRACT

The authors explore the feasibility of adding a performance option to DOE's EnergyStar© Windows program whereby windows of differing U-factors and SHGCs can qualify so long as they have equivalent annual energy performance. An iterative simulation procedure is used to calculate trade-off equations giving the change in SHGC needed to compensate for a change in U-factor. Of the four EnergyStar© Window climate zones, trade-off equations are possible only in the Northern and Southern zones. In the North/Central and South/Central zones, equations are not possible either because of large intrazone climate variations or the current SHGC requirements are already near optimum.

(download document here)

A SIMULATION-BASED TESTING AND TRAINING ENVIRONMENT FOR BUILDINGS

Peng Xu and Philip Haves (Lawrence Berkeley National Laboratory, Berkeley, CA)
Joe Deringer (The Deringer Group, Berkeley, CA)

ABSTRACT

A hybrid simulation environment for controls testing and training is described. A real-time simulation of a building and HVAC system is coupled to a real building control system using a hardware interface. A prototype has been constructed and tested in which the dynamic performance of both the HVAC equipment and the building envelope is simulated using SPARK (Simulation Problem Analysis and Research Kernel). A low cost hardware interface between the simulation and the real control system is implemented using plug-in analog-to-digital and digital-to-analog cards in a personal computer. The design and implementation of the hardware interface in SPARK are described. The development of a variant of this environment that uses a derivative of EnergyPlus to test the implementation of a natural ventilation control strategy in real control hardware is also described. Various applications of the hybrid simulation environment are briefly described, including the development of control algorithms and strategies, control system product testing and the pre-commissioning of building control system installations. The application to the education and training of building operators and HVAC service technicians is discussed in more detail, including the development of a community college curriculum that includes the use of the hybrid simulation environment to teach both control system configuration and HVAC troubleshooting.

Recent Reports

This report is available from the Simulation Research Group at Lawrence Berkeley National Laboratory.

LBNL-51434 (download document here)

GRAPH-THEORETIC METHODS IN SIMULATION USING SPARK

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ABSTRACT
This paper deals with simulation modeling of nonlinear, deterministic, continuous systems. It describes how the Simulation Problem Analysis and Research Kernel (SPARK) uses the mathematical graph both to describe models of such systems, and to solve the embodied differential-algebraic equation systems (DAEs). Problems are described declaratively rather than algorithmically, with atomic objects representing individual equations and macro objects representing larger programming entities (submodels) in a smooth hierarchy. Internally, in a preprocessing step, graphs are used to represent the problem at the level of equations and variables rather than procedural, multi-equation blocks. Benefits obtained include models that are without predefined input and output sets, enhancing modeling flexibility and code reusability, and relieving the modeler from manual algorithm development. Moreover, graph algorithms are used for problem decomposition and reduction, greatly reducing solution time for wide classes of problems.

After describing the methodology the paper presents results of benchmark tests that quantify performance advantages relative to conventional methods. In a somewhat contrived nonlinear example we show $O(n)$ performance as opposed to $O(n^3)$ for conventional methods and $O(n^2)$ for sparse methods. Another more realistic example deals with the model of a complex air-conditioning system. Comparative results show the number of simultaneous equations was reduced by a factor of 4 and the execution time reduced by a factor of ~15-20 when compared to a popular simulation program for problems in this domain. Both of these examples offer good opportunities for decomposition and reduction. A third example treats two dimensional heat transfer in homogeneous media. In this case the lack of opportunity for decomposition and reduction results in a still-large and sparse iterative problem. However, even for this example a sparse option within SPARK yields speeds comparable to a custom coded solution using state-of-the-art sparse packages. Finally, we describe recent extensions that allow developers to mix SPARK's graph-theoretic modeling paradigm with conventional procedural

(download document here)

A COMPARISON OF DETERMINISTIC AND PROBABILISTIC OPTIMIZATION ALGORITHMS FOR NONSMOOTH SIMULATION-BASED OPTIMIZATION

Michael Wetter (Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA)
Jonathan Wright (Loughborough University, Loughborough, Leicestershire, UK)

ABSTRACT
In solving optimization problems for building design and control, the cost function is often evaluated using a detailed building simulation program. These programs contain code features that cause the cost function to be discontinuous. Optimization algorithms that require smoothness can fail on such problems. Evaluating the cost function is often so time-consuming that stochastic optimization algorithms are run using only a few simulations, which decreases the probability of getting close to a minimum. To show how applicable direct search, stochastic, and gradient-based optimization algorithms are for solving such optimization problems, we compare the performance of these algorithms in minimizing cost functions with di/erent smoothness. We also explain what causes the large discontinuities in the cost functions.

BLAST*news*

www.bso.uiuc.edu

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The **Building Loads Analysis and System Thermodynamics (BLAST** program predicts energy consumption, energy system performance and cost for new or existing (pre-retrofit) buildings.

BLAST contains three major sub-programs:

- **Space Load Prediction** computes hourly space loads in a building based on weather data and user inputs detailing the building construction and operation.
- **Air Distribution System Simulation** uses the computed space loads, weather data, and user inputs.
- **Central Plant Simulation** computes monthly and annual fuel and electrical power consumption.

Heat Balance Loads Calculator (HBLC)
The BLAST graphical interface (HBLC) is a Windows-based interactive program for producing BLAST input files. You can download a demo version of HBLC (for MS Windows) from the BLAST web site (User manual included).

HBLC/BLAST Training Courses
Experience with the HBLC and the BLAST family of programs has shown that new users can benefit from a session of structured training with the software. The Building Systems Laboratory offers such training courses on an as needed basis typically at our offices in Urbana, Illinois.

WINLCCID 98
LCCID (Life Cycle Cost in Design) was developed to perform Life Cycle Cost Analyses (LCCA) for the Department of Defense and their contractors.

To order BLAST-related products, contact the Building Systems Laboratory at the address above.

Program Name	Order Number	Price
PC BLAST Includes: BLAST, HBLC, BTEXT, WIFE, CHILLER, Report Writer, Report Writer File Generator, Comfort Report program, Weather File Reporting Program, Control Profile Macros for Lotus or Symphony, and the Design Week Program. The single CD-ROM includes soft copies of the BLAST Manual, technical articles and theses related to BLAST, nearly 400 processed weather files with a browsing engine, and complete source code for BLAST, HBLC, etc.	3B486E3-0898	$1500
PC BLAST Package Upgrade from level 295+	4B486E3-0898	$450
WINLCCID 98: executable version for 386/486/Pentium	3LCC3-0898	$295
WINLCCID 98: update from WINLCCID 97	4LCC3-0898	$195

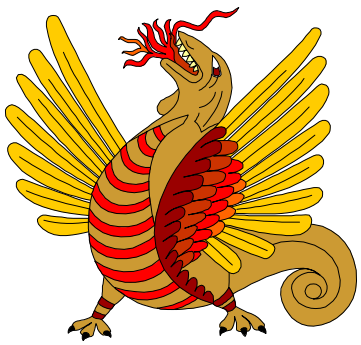
The last four digits of the catalog number indicate the month and year the item was released or published. This will enable you to see if you have the most recent version. All software will be shipped on 3.5" high density floppy disks unless noted otherwise.

JOIN THE BLDG-SIM MAILING LIST

BLDG-SIM is a mailing list for users of building energy simulation programs like EnergyPlus, DOE-2, Trace-600, HAP, BLAST, ESP, SERIRES, TRNSYS, TASE, ENERGY-10 and others. Because building simulation professionals are located worldwide, the BLDG-SIM list is an attempt to foster the development of a community of those users. Users of all levels of expertise are welcome and are encouraged to share their questions and insights about these programs. To subscribe, send a blank email message to BLDG-SIM-SUBSCRIBE@GARD.COM

The web page for BLDG-SIM is www.gard.com/bldg-sim.htm

Jason Glazer, P.E., of GARD Analytics, Inc., Is the list administrator (jglazer@gard.com).

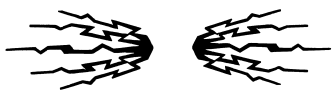


Run for safety, foolish pedestrians!

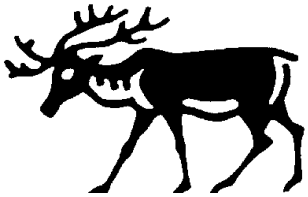
Building Energy Software

from the Environmental Energy Technologies Division of Lawrence Berkeley Laboratory

Free Downloads	
BDA 3.0 (Building Design Advisor) (building decision-making from design through completion)	**gaia.lbl.gov/BDA**
COMIS (multi-zone air flow and contaminant transport model)	**www-epb.lbl.gov/comis**
EnergyPlus 1.1.1 (new-generation whole-building energy analysis program, based on BLAST and DOE-2)	**www.energyplus.gov/**
GenOpt® 2.0β (generic optimization program)	**SimulationResearch.lbl.gov**
Optics 5.1.02 (for analyzing optical properties of glazing systems)	**windows.lbl.gov/materials/optics5/**
RADIANCE 3.5 (analysis and visualization of lighting in design)	**radsite.lbl.gov/radiance/**
Desktop Radiance 2.0β (integrates the Radiance Synthetic Imaging System with AutoCAD Release 14)	**radsite.lbl.gov/deskrad/**
Radiance Control Panel (automates some Radiance tasks once the model has been created)	**www.squ1.com/site.html**
THERM 5.2 (models two-dimensional heat-transfer effects in building components where thermal bridges are of concern)	**windows.lbl.gov/software/therm/therm.html**
VisualSPARK 2.0 (Simulation Problem Analysis and Research Kernel) (connect component models to simulate innovative building envelope and HVAC systems)	**SimulationResearch.lbl.gov**
WINDOW 5.2 (thermal analysis of window products)	**windows.lbl.gov/software/window/window.html**
Free Software / Request by Fax from 510.486.4089	
RESFEN 3.1 (choose energy-efficient, cost-effective windows for a given residential application)	**windows.lbl.gov/software/resfen/resfen.html**
Web Based (free)	
Home Energy Saver (quickly computes home energy use) and ***Home Improvement Tool*** (simplified Home Energy Saver)	**hes.lbl.gov** and **hit.lbl.gov**



DOE-2



DOE-2.1E (v. 121) 1,000-Zone version for Windows from ESTSC; other vendors of DOE-2 based programs are listed on our website: http://SimulationResearch.lbl.gov/.

Cost is as follows:

$ 300 U.S. Government/Non-Profits/Education
$ 575 U.S. Public, Mexico, Canada
$1129 to $1268 Other Foreign

DOE-2 Documentation on a CD from ESTSC - Cost US$100

What is included on the CD?

- DOE-2 Reference Manual (Part 1)
- DOE-2 Reference Manual (Part 2)
- DOE-2 Supplement to the Reference Manual (2.1E)
- DOE-2 BDL Summary (2.1E)
- DOE-2 Engineers Manual (2.1A)

Order Software and ESTSC Documentation

Ed Kidd or Kim Buckner
NCI Information Systems, Inc.
Energy Science and Technology Software Center (ESTSC)
P.O. Box 1020
Oak Ridge, TN 37831

Phone: 865/576-1037
Fax: 865/576-6436
Email: estsc@adonis.osti.gov

Purchase DOE-2 Documentation

DOE-2 Sample Run Book (2.1E) -- The Sample Run book is the only remaining DOE-2 manual not available electronically. It must be purchased separately from NTIS; ordering information may be found at http://SimulationResearch.lbl.gov > DOE-2 > Documentation

Free DOE-2 Documentation (http://simulationresearch.lbl.gov/> DOE-2 > Documentation)

DOE-2 Basics Manual (2.1E)

Update Packages: Update Packages are **not** cumulative; each one contains different information. Download all four packages then print and insert the pages into your existing DOE-2 manuals.

- Update Package #1: DOE-2.1E Basics, the Supplement and BDL Summary
- Update Package #2: BDL Summary and Supplement.
- Update Package #3: Appendix A of the Supplement.
- Update Package #4: (1000-zone DOE-2.1E) BDL Summary.

DOE-2 Modeling Tips (pdf files) for 2003 for 2002
A compilation of all the "how to" and "DOE-2 Puzzler" articles from the *Building Energy Simulation User News.*

Changes and Bug Fixes to DOE-2.1E (txt file)
Description of all changes and bug fixes in a text document.

DOE-2 listings are continued on the next page

DOE-2 (continued)

DOE-2 Training

Private or group DOE-2 courses for beginning and advanced users.
Contact Marlin Addison at (602) 968-2040, marlin.addison@doe2.com

DOE-2 Help Desk

Email (klellington@lbl.gov) or fax the Simulation Research Group with your questions. Fax: (510) 486-4089

ENERGY-10, VERSION 1.6

ENERGY-10 is a design tool for smaller residential or commercial buildings that are less than 10,000 ft^2 or buildings that can be treated as 1- or 2-zone increments. It performs whole-building energy analysis for 8760 hours/year, including dynamic thermal and daylighting calculations. ENERGY-10 was specifically designed to facilitate the evaluation of energy-efficient building features in the very early stages of the design process.

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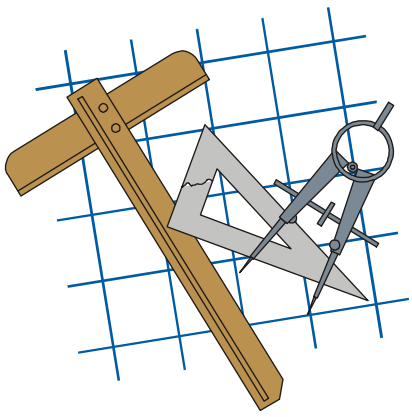
Washington, DC 20004

Tel: 202.628.7400 ext 210
Fax: 202.383.5043
www.sbicouncil.org

Sustainable Buildings Industry Council (SBIC)

ENERGY-10 User Group www.sbicouncil.org/forum

SBIC Bookstore http://www.sbicouncil.org/store/resources.php



Building Energy Tools Directory

The web-based Building Energy Tools Directory contains information on more than 270 building-related software tools from around the world.

For each tool in the directory, a short description is provided, along with information about technical expertise required, users, audience, input, output, validation, computer platforms, programming language, strengths, weaknesses, technical contact, availability and cost. A link is also provided for directly translating the web pages into more than eight languages.

Know of a tool (yours?) that isn't in the directory? Visit http://www.eere.energy.gov/buildings/tools_directory/your_software_here.html or contact Dru Crawley at Drury.Crawley@ee.doe.gov.

VisualDOE Training

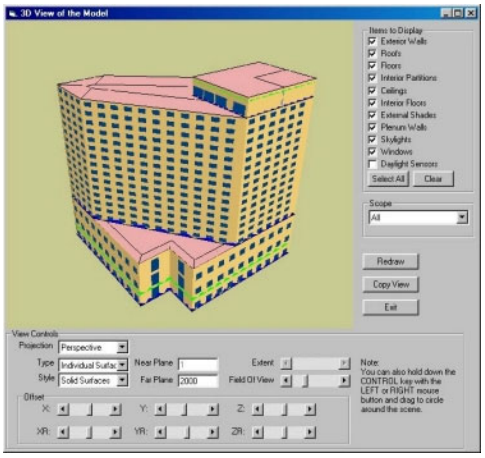
October 20-22, 2004 in San Francisco

Architectural Energy Corporation is pleased to announce upcoming VisualDOE 4.0 professional training seminars. These courses provide hands-on DOE-2 simulation experience and covers the full range of VisualDOE 4.0 features.

VisualDOE Training

This hands-on two-day training session provides a detailed overview of building energy simulation with VisualDOE and a brief introduction to DOE-2.1E.

Attendees who bring their own laptop computer will gain experience through modeling exercises.



VisualDOE LEED Training only

This optional third day training focuses on how to use VisualDOE 4.0 for LEED energy saving calculations. Order VisualDOE training.

Customized Training

Customized Training is available for VisualDOE on request. One-half to two-day sessions are possible.

Architectural Energy Corporation

142 Minna Street San Francisco, California 94105
Telephone: (415) 957-1977 Fax: (415) 957-1381

Free Workshops and Seminars from …

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL® Company

Southern California Edison
Customer Technology Application Center
6090 North Irwindale Ave.
Irwindale, CA 91702
Phone - 1-800-336-2822 x2537, FAX - (626) 812-7508

http://www.sce.com/sc3/002_save_energy/002f_ctac/002f1_about_ctac/default.htm

September 16 9:00 AM - 12:00 PM	**#11089 Design Strategies for High Performance Glass** ♦ Find out how selection and use of glass in your facility will influence the energy efficiency of your building and its energy costs.
September 16 (w/lunch) 8:30 AM - 4:00 PM	**#10312 Energy Management Systems (EMS)** ♦ Maximize savings using the most current technology in HVAC control methods. This seminar is recommended for those who have some understanding of HVAC.
September 23 (w/lunch) 8:30 AM - 4:00 PM	**#10290 Implementing Energy Efficiency Projects** ♦ Learn how to perform energy assessments, screening audits, feasibility studies, and the selection of proper equipment.
September 24 8:30 AM - 12:30 PM	**#11663 Integrated School Building Design Seminar** ♦ Focus on Collaborative for High Performance Schools (CHPS) and Savings by Design. Discussion includes energy efficiency, sustainable design, student comfort and productivity.
October 27 (w/ lunch) 9:00 AM - 4:30 PM	**#11958 CHPS Design Training** ♦ More about high performance schools. Daylighting design, high performance electric lighting, optimized HVAC systems, site planning and materials, etc.

Software from Canada's Buildings Group

The Buildings Group is one of 10 energy technology R&D groups that make up the CANMET Energy Technology Centre (CETC).

Lightswitch Wizard

The Lightswitch Wizard performs an on-line analysis of lighting and daylighting scenarios for spaces with windows equipped with blinds. The user interface was greatly simplified to assist designers assess various lighting configurations based on the amount of daylight actually available from the windows.

SkyVision Software

Interested in including a skylight in your next building design, but not quite sure if the benefits outweigh the costs? Looking for ways to improve the design of the skylights you currently manufacture? SkyVision is an easy-to-use Windows-based software program.

GS2000™ is a software program, first released in 1995, for the sizing of ground heat exchangers for ground-source heat pumps (earth energy systems, geothermal heat pumps, Geoexchange).

Software for residential basement and slab-on-grade heat-loss analysis.

FramePlus

The latest software for assessing the thermal performance and condensation potential of any complex building assembly or product.

HOT2000™ is a low-rise residential energy analysis and design software.

HOT3000™ replaces the bin-based energy analysis core in HOT2000™ with a more flexible and expandable energy analysis core based on the ESP-r program.

HOT2®XP serves as a quick and easy tool for analyzing energy use in residential buildings.

HOT2®EC is the performance compliance program that allows for much greater flexibility in the design of the building. .

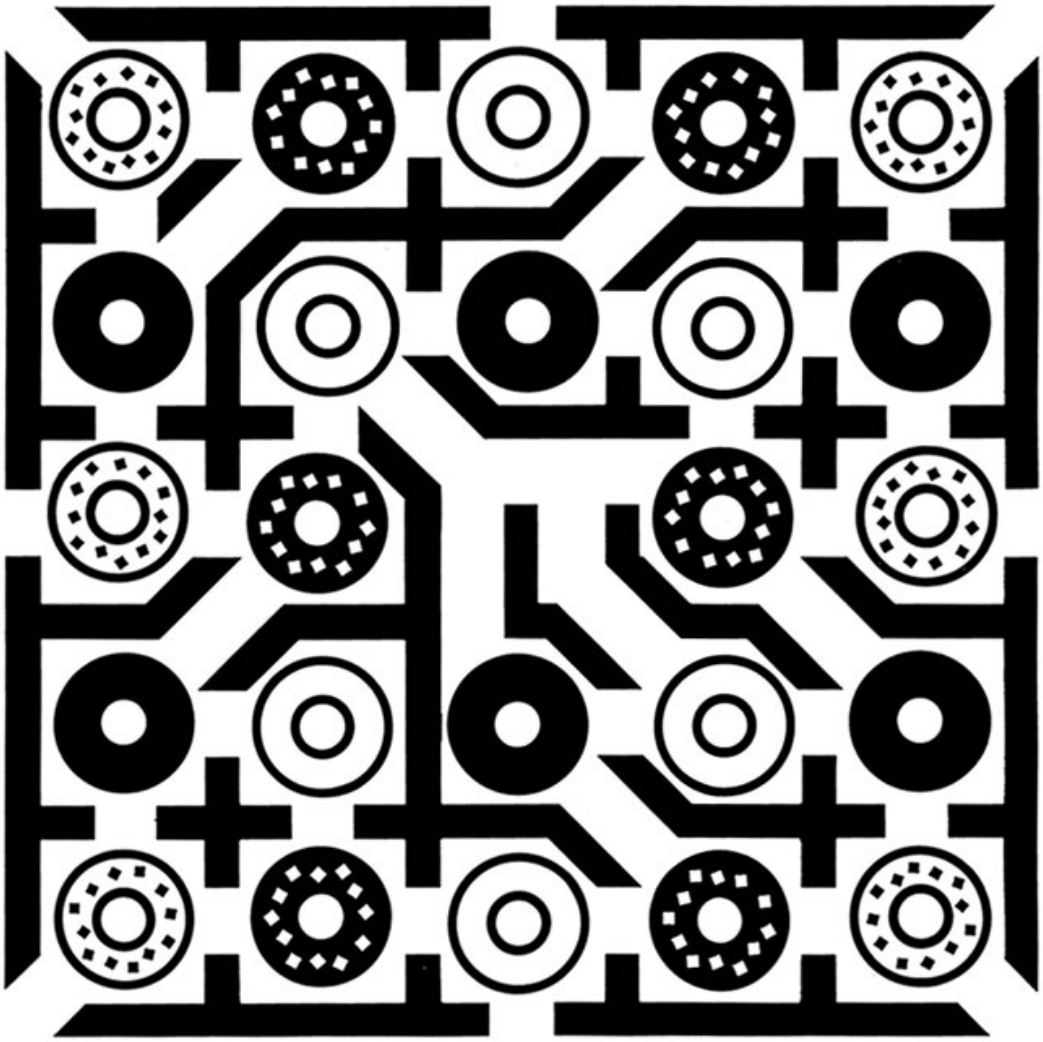
HOUSTRAD™ is a computer program which was developed specifically for the Energy Code Trade-offs Compliance method and which meets these requirements.

EE4 offers maximum design flexibility in measuring compliance using the MNECB performance path. Use it to ensure your proposed building will not consume more energy than if every element of the building envelope, lighting, HVAC and service water systems were designed in accordance with strict prescriptive requirements under the model code.

Building designers now have a new software tool to analyse building envelope energy efficiency. BILDTRAD™ is an easy way to compare energy efficiencies of wall and window combinations in commercial and multi-unit residential buildings.

The GBTool™ software has been developed as part of the Green Building Challenge process, an international effort to establish a common language for describing "green buildings".

NRC·CNRC IRC Institute for Research in Construction National Research Council Canada Conseil national de recherches Canada Canada



Two Dozen Doughnuts

Find a path that enters the maze, passes through all doughnuts, and exits the maze, without using any part of a path more than once. You must have three of each kind of doughnut in the first dozen and in the second dozen as well.

For the solution to this maze, see the last page of **Section 2** of this newsletter.